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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/074,888	02/13/2002	Benjamin C.E. Schwarz	5298-06900 PM01027	6502

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 10/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/074,888	Applicant(s) SCHWARZ ET AL.	
	Examiner DuyVu n. Deo	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11, 13-15, 17, 18, 37 and 38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 13-15, 17, 18, 38-37 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 4-8 are rejected under 35 U.S.C. 102(e) as being anticipated by Keil et al. (US 6,630,407).

Keil describes an etching method comprising: etching a stack of layers within a single etch chamber (col. 2, line 18-30, 44-45), the layers comprises an organic ARC layer, a nitride layer arranged beneath and in contact with the ARC layer, and underlying layer beneath the nitride layer. Argon is introduced during etching of the ARC (col. 2, line 39, 40). This would read on claimed a noble gas heavier than helium is introduced into the chamber during the etching.

Since claim 1 requires etching one or more layers, the limitation of "...etching more layers in the stack with a different etch chemistry than used for etching other layers in the stack and introducing a first noble gas and a second noble gas, each heavier than helium... for assisting the etching of a different layer in the stack of layers" doesn't have the patentability because it applies to the etching of at least 2 layers, which is not necessarily to be done or required.

Referring to claims 7, 8, the underlying layer can comprise polycrystalline silicon (col. 5, line 14).

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The etching chamber used for the test is an oxide etch system (col. 4, line 26-28). The oxide would be silicon oxide. Therefore, the chamber would also have to be configured for etching material comprising silicon. This would read on claimed the etch chamber is configured for etching a material comprising silicon.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keil (6,630,407).

Referring to claims, 9 and 10, at the time of the invention, it would have been obvious to one skilled in the art that the underlying can be monocrystalline silicon or silicon-germanium depending on the device being manufacturing since Keil suggests that the underlying layers can be semiconductor layer (col. 5, line 14).

5. Claims 2, 3, 11, 13-15, 17, 18, 28-33, 35, 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keil as applied to claims 1, 11, 29, 32 above, and further in view of Khajehnouri et al. (US 6,117,786).

Unlike claimed invention, Keil doesn't describe etching layers in the stack with a different etch chemistry than used for etching other layers in the stack, or the etching the underlying layer with an etch chemistry different that that of the first and second chemistries.

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However, he suggests to etch the ARC selectively to other layers and the ARC etch chemistry is tailored so that it would etch the ARC selectively to the under layer including the nitride layer (col. 2, line 5-10). It would have been obvious to one skilled in the art to etch the layers in the stack with etch chemistry that is tailored for each layer in order to provide a selectively etching for each layer. This would provide claimed etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack.

Referring to claim 11, the etching reactor includes inductively coupled plasma reactor (col. 2, line 23), which is also a low-density plasma etch chamber (please see cited art below).

Referring to claims 2, 3, 11, 12, 14, 17, 18, 31, 33, 37, using noble gas during etching is well known to one skilled in the art as shown here by Khajehnouri. He teaches of using noble gases including ones that heavier than He such as Ar, Ne, Kr, Xe as carrier gases during the etching process (col. 2, line 18-20). Even though applied prior art doesn't suggest at least one of the first, second and third noble gases differs from the remaining noble gases; however, in the absent of unexpected result, using any of those noble gases for each step would be obvious with a reasonable expectation of success.

Referring to claim 30, since the nitride layer is exposed as the ARC is being etched away, some of the nitride layer (claimed a portion of the nitride layer) would also be etched away.

Referring to claim 28, Keil suggests the Ar flow rate is 50-500 sccm (col. 8, line 46) and he teaches that the gas flow rate depends on the size of the substrate, type of plasma reactor, power settings, etc. (col. 8, line 65-col. 9, line 3); therefore, it would have been obvious to determine the Ar flow rate through routine experimentation depending on the above parameters in order to provide optimum Ar flow rate with a reasonable expectation of success.

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Referring to claim 35, the underlying layer can comprise metals, which would form claimed interconnect line and they have dimension within a CD specification (col. 1, line 60-65; col. 5, line 5-17).

Referring to claim 15, Keil further shows a pattern photoresist layer arranged over the ARC before etching the ARC and removing the remaining of the photoresist and the ARC layers subsequent to etching the cap nitride layer (col. 5, line 42-53).

6. Claims 34 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keil as applied to claim 32 above, and further in view of Lim et al. (US 6,403,484).

Referring to claims 34, since Keil suggests the underlying layer can be different kind of layers including semiconductor layers and this would form different type of device including claimed forming dielectric material in the opening of the underlying layer to form isolation structure. This process of forming isolation structure is well known to one skilled in the art at the time of the invention as shown here by Lim (col. 3, line 4-14), who also shows forming the nitride by thermal growing is a process practiced by one skilled in the art at the time of the invention (col. 3, line 38-40). Therefore, it would have been obvious to one skilled in the art that an isolation structure can be formed in light of Keil and Lim with a reasonable expectation of success.

7. Hung et al. shows prior art (col. 3, line 35; col. 4, line 31-33).

Response to Arguments

8. Applicant's argument that Keil doesn't explicitly teaching of etching the layers in the stack with a different etch chemistry for each layer in the stack is acknowledge (this does not apply to claims 1-10 since they don't require etching 2 layers but one, because claim 1 recites etching one or more layers). However, he describes etching the ARC layer in the stack selectively to above and under layers (col. 3, line 25-32) and he teaches that the selective etching is to minimize attacking of the under layers and to improve the uniformity, CD, and profile of the openings (col. 4, line 1-18), therefore, one skilled in the art would find it obvious to etch other layers selectively, which would have to require different etching chemistry for each layers, in order to provide improvement in uniformity, profile, and CD of the openings.

Applicant's argument that Keil suggests using the same chemistry for etching the ARC and the under layer as shown in col. 4, line 15-25 is found unpersuasive because he only describes the affective of the CO on the underlying dielectric layer, but not a step of etching the underlying dielectric layer.

The etching chamber used for the test is an oxide etch system (col. 4, line 26-28). The oxide would be silicon oxide. Therefore, the chamber would also have to be configured for etching material comprising silicon. This would read on claimed the etch chamber is configured for etching a material comprising silicon.

Applicant's argument that Keil doesn't describe the first and second different noble gases are different from one another is acknowledged. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413,

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208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Since the uses of those noble gases that are heavier than the He are known to one skilled in the art as carrier gases, as described above by Khajehnouri, in the absent of unexpected result, using any of those carrier gases wherein each step uses a different carrier would be obvious to one skilled in the art at the time of the invention with a reasonable expectation of success.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. Claims 1-11, 13-15, 17-18, 28-37 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicant has not shown where in the specification teaching of the limitation of using the noble gases wherein the first noble gas is different from the second noble gas and the limitation of the 1st, 2nd, and 3rd noble gases differ from the remaining noble gases.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

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MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner

Duy-Vu N. Deo

10/14/05

